REMARKS

The Office has removed all of the grounds of rejection in the previous Action in view of the amendments to the claims made in the Submission under 37 C.F.R. § 1.114 filed with the Request for Continued Examination of the present application on July 14, 2008. A new objection to and new rejections of the claims are made in the present Action. These are discussed below.

Claim Objections

Claim 34 has been amended to correct the informality kindly noted by the Examiner.

Claim Rejections - 35 U.S.C. § 112

Claims 20-22, 24-26, 28-30, and 40-45 are rejected under the second paragraph of 35 U.S.C. § 112 as being indefinite.

The rejection as it applies to claim 20 is not correct. Antecedent basis for the recitation "the silicon wafer not containing COP" in lines 8-9 of claim 20 is provided in the preamble of the claim, lines 1-2.

The rejection as it applies to claims 28-30 has been rendered moot by the cancellation of these claims.

Regarding the rejection as it applies to claim 40, the issue raised under the second paragraph of 35 U.S.C. § 112 is whether a person of ordinary skill in the art could understand the scope of

the claim, i.e., the subject matter that would infringe the claim, based on his knowledge and a reading of the specification disclosure. Applicants respectfully submit that a person of ordinary skill in the art would understand the "predetermined temperature" to be the temperature which causes part of the active layer side silicon wafer to separate from a boundary defined by said ion implanted layer.

Moreover, applicants note that the Office characterizes the Momoi et al. reference, U.S. Patent Application Publication No. 2002/0024152 ("Momoi"), as teaching "separating a part of the active layer side silicon wafer from a boundary defined by the ion implanted layer by holding the bonded wafer at a predetermined temperature to thereby apply a heat treatment thereto." Momoi and the Office's characterization of Momoi are evidence that a person of ordinary skill in the art will understand the temperatures within the scope of a "predetermined temperature".

The 35 U.S.C. § 112 rejection of claim 41 has been overcome by by changing "the separated active layer side wafer" to --the separated part of said active layer side silicon wafer-- (as recited in claim 40) and by changing "it" to --said separated part of said active layer side silicon wafer--.

Claim Rejections - 35 USC § 103(a)

The propriety of all of the 35 U.S.C. § 103(a) rejections depends on whether the Office has properly characterized the differences between the method of the present invention and the method disclosed by Hölzl et al., U.S. Patent No. 6,803,331 ("Hölzl"), whether there is motivation to make the modification to Hölzl proposed by the Office and whether such modification will result in the method and silicon wafer not including COP of the present invention. Therefore, the rejections stand or fall together and need not be separately addressed.

The Office characterizes Hölzl as disclosing each of the limitations of claims 20, 22, 24 and 26 but is "silent about values of $[O_i]^{eq}(T)$ and $2\sigma_{SiO2}\Omega/r$, as annealing parameters, in which each has a constant value in such a way that $[O_i]$ varies with the variation of (T) in the silicon wafer heat treatment process." (Action, page 7, line 2 from the bottom of the page, to page 8, line 2).

Hull is identified as somehow teaching the "constant values for the annealing parameters" not disclosed by Hölzl.

Based on these characterizations of Hölzl and Hull, the Office concludes (Action, page 8, line 4 from the bottom of the page, to page 9, line 4) that:

"it would have been obvious for one of ordinary skill in the art at the time of applicant's invention to modify the manufacturing method of a silicon single crystal as taught by Hölzl et al. (US '331) through providing constant values for the annealing parameters in such a way that the concentration of interstitial oxygen varies with the variation of the annealing temperature in order to minimize distribution of the dislocations and crystalline defects throughout the silicon single crystal wafer surface, as suggested by Hull, R."

Applicants respectfully submit that the proposed modification of Hölzl will not result in the method of the present invention.

Using the description of "Properties of Crystalline Silicon" on page 489 of Hull for [Oi]eq, and letting θ = 310 erg/cm2, Ω = 2.27E-23 cm3/mol, k = 8.617E-5 eV, T = 1000 to 1350°C and r = 15 to 100 nm, the results of the calculations for [Oi] in Equation (1) in the specification of Hölzl are given in the attached Table 1 and Fig. 1.

The scope of the claimed subject matter of Hölzl is on the lower side of the curve for Hölzl in Fig. 1, but the term for the exponent in the equation in Hölzl is substantially equal to 1 in the range for r and T described above. Therefore, [Oi] in Hölzl

and [Oi]eq in Huff are substantially the same. In other words, the equation in Hölzl shows nothing more than the solid solubility of oxygen.

On the other hand, as is described in the specification of the present application, applicants carried out heat treatment of silicon wafers with different values for [Oi], varying the temperature, and examined the relationship between the limit of [Oi] for making COP vanish and temperature, and obtained the empirical formula of the present invention. The claimed subject matter of the present invention is equal to or below the curve shown by the black dots (Umeno et al.) in Fig. 1. The formula of the present invention shows that COP is only made to vanish when the oxygen concentration is clearly below the solid solubility for oxygen ([Oi]eq in Huff). This fact has the following significance. First, even if the temperature of the wafer increases and the solid solubility of oxygen ([Oi]eq) becomes the same as the oxygen concentration in the wafer, the oxide film (SiO_2) present within (inside wall) the COP does not dissolve, and no COP annihilation reaction occurs. Second, when the temperature increases further and the solid solubility of oxygen ([Oi]eq) becomes clearly higher than the oxygen concentration in the wafer, the oxide film (SiO_2)

present within (inside wall) the COP dissolves, and the COP is made to vanish.

Hölzl does not disclose and does not otherwise suggest that if the oxygen concentration in the wafer is not clearly lower than [Oi]eq in Hull, the oxide film (SiO_2) present within (inside wall) will not dissolve, and the COP annihilation reaction will not occur.

As evidence of this fact, there is a description in Hölzl of examples where there is no vanishing of COP even within the range of their claims (for details, see the explanation of the data of attached Table 2).

For these reasons, it is not possible by combining Hölzl and Hull to obtain the method of the present invention and, more specifically, to obtain the relationship between the temperature T and the interstitial oxygen concentration [Oi] as recited in the claims of the present application.

Haas et al., US 4,119,441, and Momoi et al., US 2002/0024152, do not overcome the deficiencies of the combination of Hölzl and Huff. Moreover, in view of the failure of the combination of Hölzl and Hull to obtain the relationship between the temperature T and the interstitial oxygen concentration [Oi] of the present

invention, Momoi et al. cannot be properly modified to obtain the method recited in claim 32 and the claims dependent thereon.

Removal of the 35 U.S.C. § 103(a) rejections of the claims of the application is in order and is respectfully solicited.

The foregoing is believed to be a complete and proper response to the Office Action dated August 27, 2008.

In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time. The fee for any such extension and any other required fees may be charged to Deposit Account No. 111833.

Respectfully submitted,
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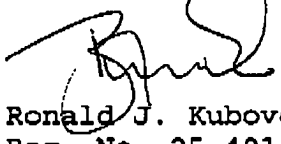

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Attachments: Tables 1 and 2 and Fig. 1

Table 1

		[Oi](Holzl)				
T(°C)	[Oi]eq(Huff)	Holzl(r=15nm)	Holzl(r=25nm)	Holzl(r=50nm)	Holzl(r=100nm)	Umeno et al.
1000	1.41E+17	1.49E+17	1.46E+17	1.44E+17	1.43E+17	1.70E+17
1010	1.58E+17	1.66E+17	1.63E+17	1.60E+17	1.59E+17	1.83E+17
1020	1.75E+17	1.85E+17	1.81E+17	1.78E+17	1.77E+17	1.96E+17
1030	1.94E+17	2.05E+17	2.01E+17	1.98E+17	1.96E+17	2.11E+17
1040	2.16E+17	2.27E+17	2.22E+17	2.19E+17	2.17E+17	2.26E+17
1050	2.38E+17	2.51E+17	2.46E+17	2.42E+17	2.40E+17	2.42E+17
1060	2.64E+17	2.77E+17	2.72E+17	2.68E+17	2.66E+17	2.59E+17
1070	2.91E+17	3.06E+17	3.00E+17	2.95E+17	2.93E+17	2.77E+17
1080	3.20E+17	3.37E+17	3.30E+17	3.25E+17	3.23E+17	2.96E+17
1090	3.52E+17	3.70E+17	3.63E+17	3.58E+17	3.55E+17	3.16E+17
1100	3.87E+17	4.07E+17	3.99E+17	3.93E+17	3.90E+17	3.37E+17
1110	4.25E+17	4.46E+17	4.37E+17	4.31E+17	4.28E+17	3.59E+17
1120	4.65E+17	4.89E+17	4.79E+17	4.72E+17	4.69E+17	3.82E+17
1130	5.09E+17	5.34E+17	5.24E+17	5.17E+17	5.13E+17	4.07E+17
1140	5.57E+17	5.84E+17	5.73E+17	5.65E+17	5.61E+17	4.32E+17
1150	6.07E+17	6.37E+17	6.25E+17	6.16E+17	6.12E+17	4.59E+17
1160	6.62E+17	6.94E+17	6.81E+17	6.72E+17	6.67E+17	4.86E+17
1170	7.21E+17	7.56E+17	7.42E+17	7.31E+17	7.26E+17	5.15E+17
1180	7.84E+17	8.22E+17	8.06E+17	7.95E+17	7.90E+17	5.46E+17
1190	8.52E+17	8.92E+17	8.76E+17	8.64E+17	8.58E+17	5.78E+17
1200	9.24E+17	9.68E+17	9.50E+17	9.37E+17	9.31E+17	6.11E+17
1210	1.00E+18	1.05E+18	1.03E+18	1.02E+18	1.01E+18	6.45E+17
1220	1.08E+18	1.14E+18	1.11E+18	1.10E+18	1.09E+18	6.81E+17
1230	1.17E+18	1.23E+18	1.21E+18	1.19E+18	1.18E+18	7.19E+17
1240	1.27E+18	1.33E+18	1.30E+18	1.28E+18	1.28E+18	7.58E+17
1250	1.37E+18	1.43E+18	1.41E+18	1.39E+18	1.38E+18	7.98E+17
1260	1.48E+18	1.54E+18	1.52E+18	1.50E+18	1.49E+18	8.40E+17
1270	1.59E+18	1.66E+18	1.63E+18	1.61E+18	1.60E+18	8.84E+17
1280	1.71E+18	1.79E+18	1.76E+18	1.73E+18	1.72E+18	9.29E+17
1290	1.84E+18	1.92E+18	1.89E+18	1.86E+18	1.85E+18	9.77E+17
1300	1.98E+18	2.06E+18	2.03E+18	2.00E+18	1.99E+18	1.03E+18
1310	2.12E+18	2.21E+18	2.18E+18	2.15E+18	2.13E+18	1.08E+18
1320	2.27E+18	2.37E+18	2.33E+18	2.30E+18	2.29E+18	1.13E+18
1330	2.44E+18	2.54E+18	2.50E+18	2.47E+18	2.45E+18	1.18E+18
1340	2.61E+18	2.72E+18	2.67E+18	2.64E+18	2.62E+18	1.24E+18
1350	2.79E+18	2.91E+18	2.86E+18	2.82E+18	2.81E+18	1.30E+18

to vanish if a [Oi] = 8E17 wafer is heat treated at 1220°C. Similarly, COP would be expected to vanish if a [Oi] = 9E17 wafer is heat treated at 1250°C. However, COP does not vanish in the examples. The reason is that the conditions for COP to vanish that we obtained experimentally have not been met.